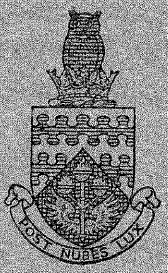
CoA Note No. 55

THE COLLEGE OF AERONAUTICS

CRANFIELD



STABILITY OF HONEYCOMB SANDWICH PANELS IN SHEAR

by

R. NICHOLS

NOTE NO. 55

OCTOBER 1956

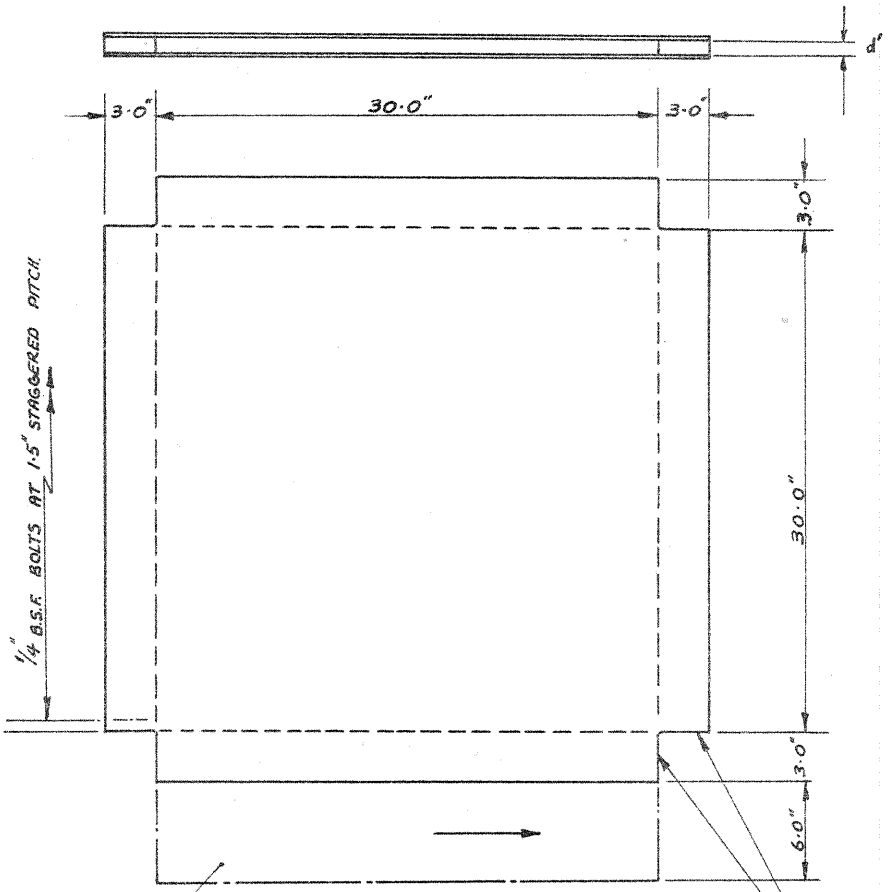
T H E C O L L E G E O F A E R O N A U T I C S

C R A N F I E L D

The Stability of Honeycomb Sandwich Panels in Shear

Abstract of the Thesis by R. Nichols, presented May 1955.

This abstract presents the results obtained by theoretical and experimental methods for the buckling of honeycomb sandwich panels in shear. Details of the specimens analysed are shown in Figs. 1 and 2. The test rig is shown in Fig. 3, and the accuracy with which uniform shear was obtained is illustrated in Fig. 4. The experimental results are given in Fig. 5, where buckling and failing shear stresses are plotted against the ratio panel width "b" to panel thickness "d". No consistent effect attributable to the difference in face thickness for the panel series A and B is shown by these results. Comparison between theory and experiment is shown in Figs. 6 and 7. The results for buckling agree substantially with plate theory for the case of simply supported edges. Corrections of plate theory to allow for shear flexibility of the filling can virtually be neglected. Discrepancies between theory and experiment for $b/d < 80$ are probably due to an insufficiently accurate allowance for plasticity.



FILLING ~ HARD TEMPER ALUM. FOIL 0·003" THICK ~ SYMMETRICAL HEX. HONEYCOMB.
FACES ~ 26 S.W.G. & 22 S.W.G. ALUM. ALLOY ~ SPEC. D.T.D 546.
BOTH FACES CUT FROM SAME SHEET.

PANEL Nº.	FILLING THICKNESS d'
1	0·60"
2	0·40"
3	0·30"
4	0·25"
5	0·20"

'A' SERIES PANELS ~ 1 OFF EACH FILLING THICKNESS, WITH FACES 26 S.W.G. (0·018") DESIGNATED PANEL Nº 1A; 2A...ETC.

'B' SERIES PANELS ~ AS ABOVE BUT WITH 22 S.W.G FACES (0·028")

FIGURE 1 - DETAILS OF PANEL SPECIMENS

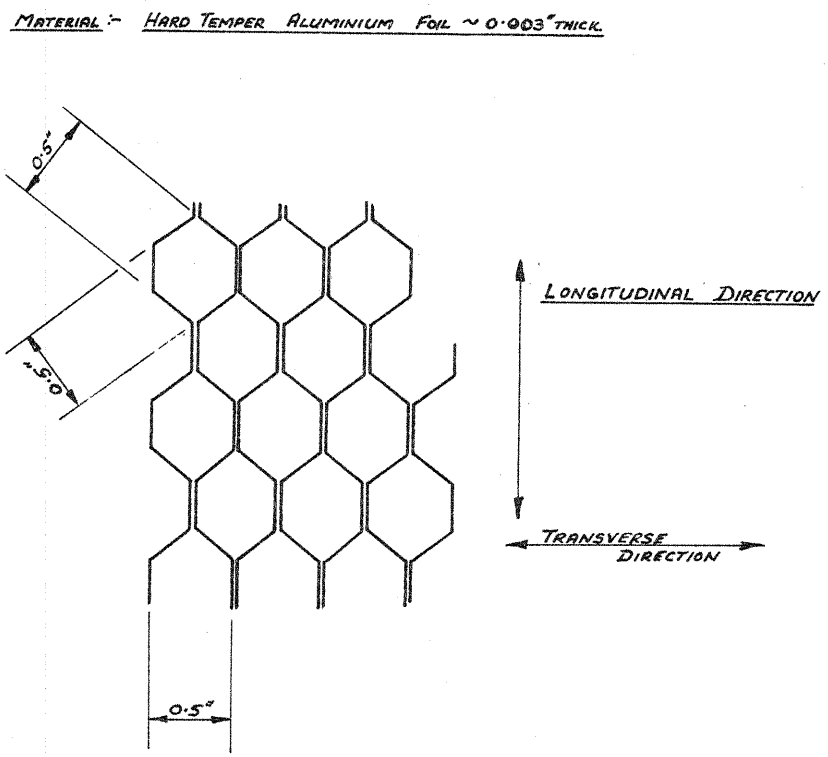
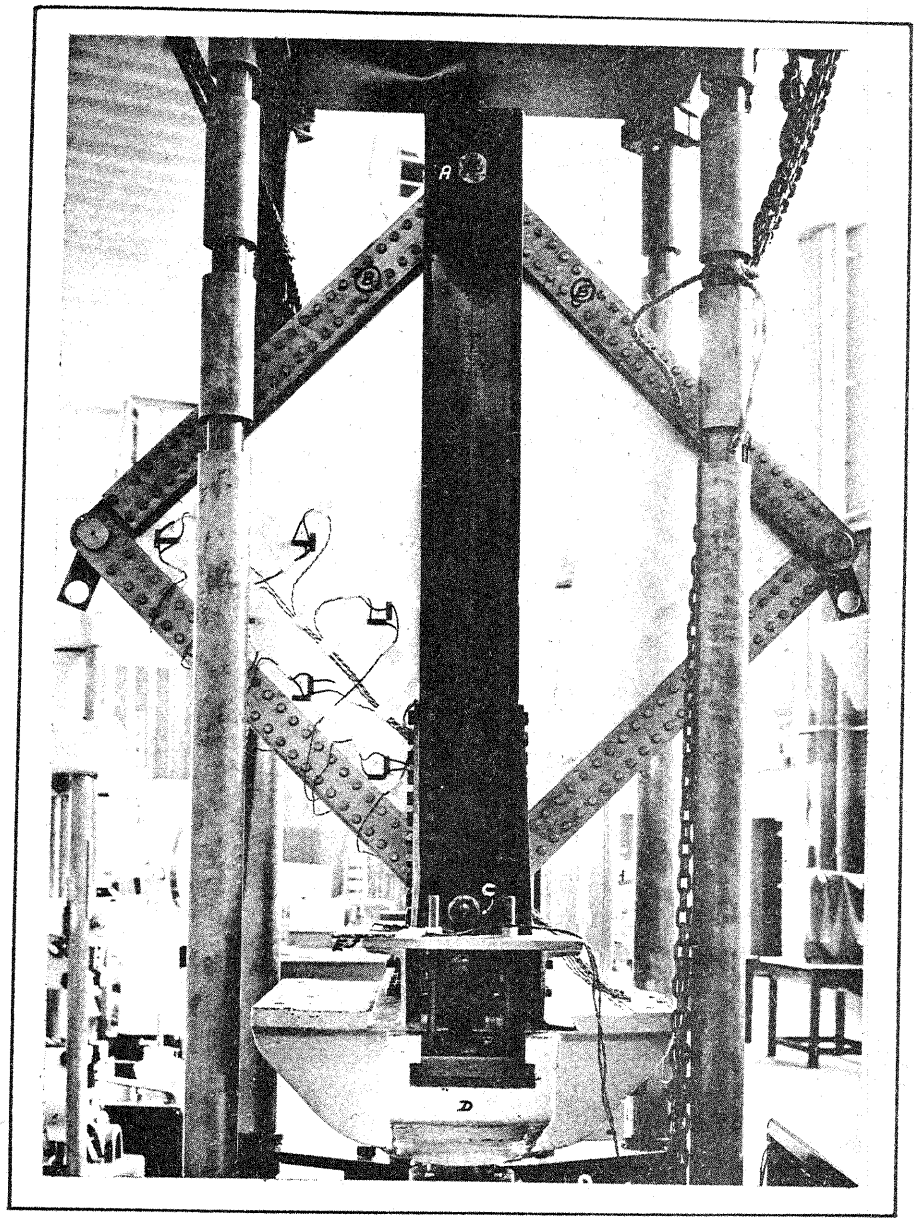


FIGURE 2 - GEOMETRY OF HONEYCOMB FILLING



Key: A - upper suspension pin
B - shear panel test frame
C - lower shackle links and pins
D - moving platen of testing machine
E - dummy strain gauges
Testing machine - 50 ton Avery 'Universal'

FIGURE 3 - END VIEW ON TEST RIG

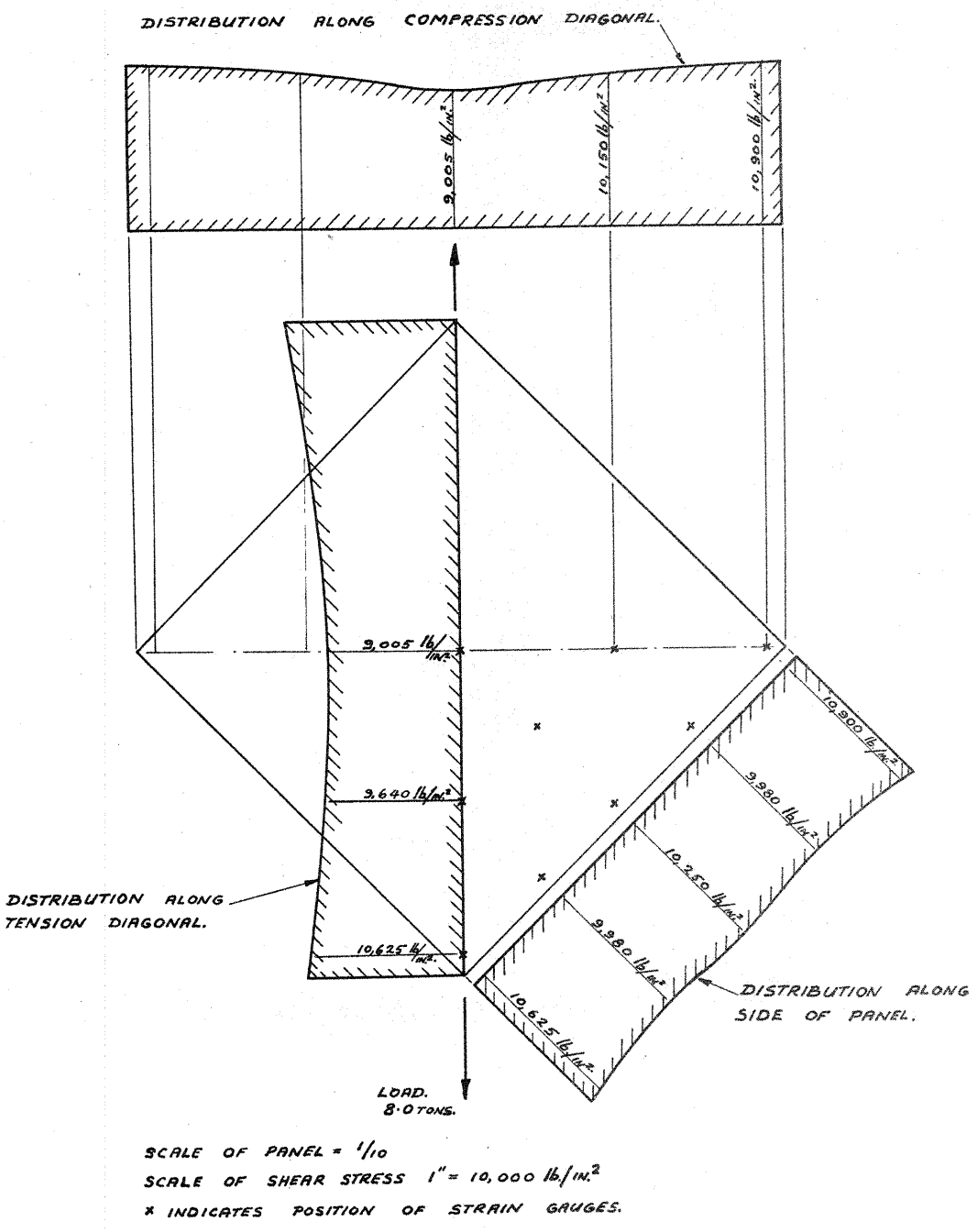


FIGURE 4 - DISTRIBUTION OF SHEAR STRESS ON PANEL NO. 3A. AT A SHEAR LOAD OF 5.65 TONS

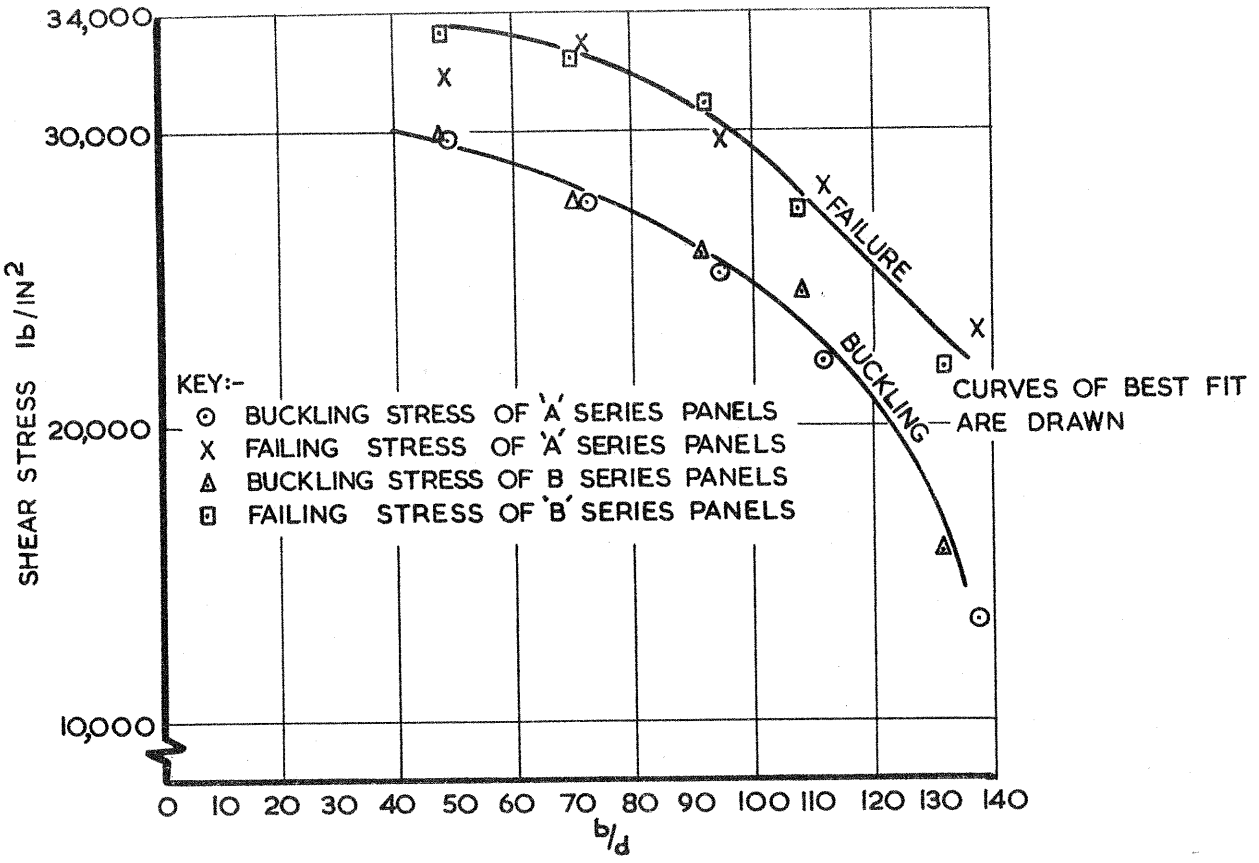


FIG. 5. EXPERIMENTAL BUCKLING & FAILING STRESSES.

['A' SERIES PANELS ~ FACES 0·018" THICK - MATERIAL D.T.D. 546.]
['B' SERIES PANELS ~ FACES 0·028 THICK - MATERIAL D.T.D. 546.]

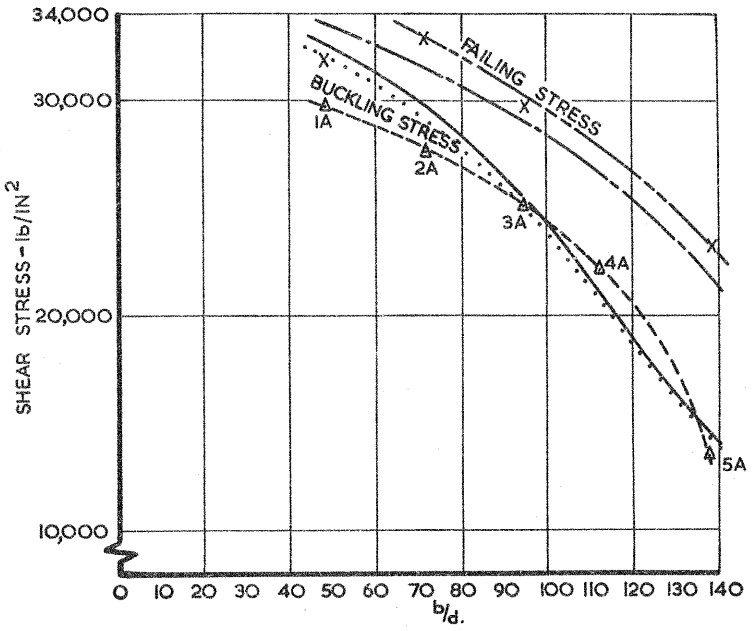


FIG. 6. COMPARISON OF EXPERIMENTAL & THEORETICAL RESULTS
('A' SERIES PANELS ~ FACES 0·018" THICK)

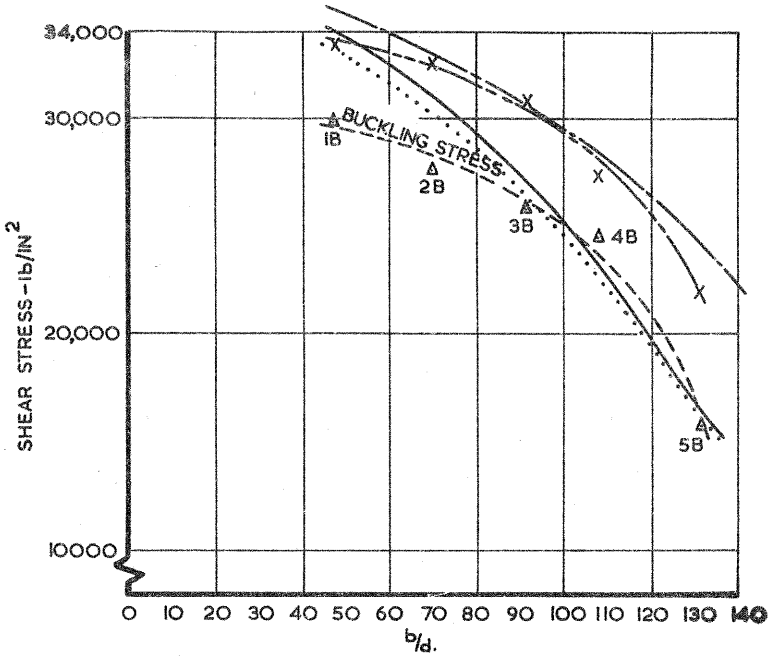


FIG. 7. COMPARISON OF EXPERIMENTAL & THEORETICAL RESULTS
('B' SERIES PANELS ~ FACES 0·026" THICK)

KEY:—

b = WIDTH OF PANEL 30"
d = DEPTH OF FILLING BETWEEN MEDIAN PLANES OF FACES
——Δ EXPERIMENTAL BUCKLING STRESS
——X EXPERIMENTAL FAILING STRESS
— — — THEORETICAL BUCKLING STRESS FOR PANEL HAVING CLAMPED EDGES - EQUIVALENT PLATE THEORY
——— THEORETICAL BUCKLING STRESS FOR PANEL HAVING SIMPLY SUPPORTED EDGES - EQUIVALENT PLATE THEORY
CORRECTED EQUIVALENT PLATE THEORY FOR SIMPLY SUPPORTED PANEL